Document 1, for example. In Patent Documents 2 and 3, a material comprising as a base resin a closed polyimide or the like for reducing thermal damage to surrounding components has been proposed. In Patent Document 4, a photosensitive adhesive composition mainly composed of an alkali-soluble polyimide resin that shows excellent low-temperature laminate properties after pattern formation has been proposed.

Patent Document 1: JP 2008-239802 A

Patent Document 2: WO 2004/109403

Patent Document 3: WO 2007/4569

Patent Document 4: JP 2009-167381 A

SUMMARY ~~OF THE INVENTION~~

PROBLEMS TO BE SOLVED ~~BY THE INVENTION~~

[0004]

However, it was difficult to simultaneously achieve thermocompressibility after exposure and sufficient adhesiveness with the conventional polyimide-based adhesives described in Patent Documents 1 to 4. In particular, the conventional polyimide-based adhesives had problems in that they provide insufficient compression when performing compression at a low temperature to an irregular substrate such as a patterned substrate after exposure and that the adhesive strength decreases as a result of a high-temperature treatment such as reflow soldering. If the thermocompressibility to an irregular substrate at a low temperature is poor, a problem arises in that when a chip is bonded to a substrate afterwards, voids occur between the chip and the irregular substrate, which results in adhesion failure, leading to reduced reliability as a semiconductor package.

[0005]

In view of these circumstances, an object of the ~~present invention~~embodiments disclosed herein is to provide a photosensitive adhesive having the ability to form patterns with an alkaline

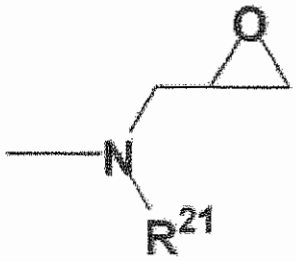
developer, excellent thermocompressibility at a low temperature to an irregular substrate after exposure, and a high adhesive strength even at a high temperature.

MEANS FOR SOLVING THE PROBLEMS

[0006]

The problems of the present ~~invention~~ disclosure described above can be solved by a photosensitive adhesive composition comprising (A) an alkali-soluble polyimide having structural unit(s) represented by Formula (1) below and having a structure represented by Formula (2) and/or (3) at least one end of the main chain, (B) a glycidylamine type epoxy compound represented by Formula (4) or (5) below, (C) a photopolymerizable compound, and (D) a photoinitiator, wherein (A) the alkali-soluble polyimide has a glass transition temperature of 160°C or higher.

[0007] [Chemical Formula 1]



(6)

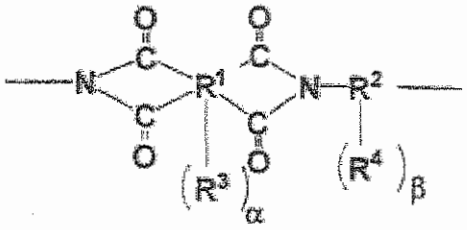
[0012]

(In Formula (6) above, R^{21} is glycidyl group or C_1-C_5 alkyl group.)

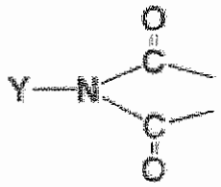
[0012a]

In a first aspect, there is provided a photosensitive adhesive composition comprising (A) an alkali-soluble polyimide having structural unit(s) represented by Formula (1) below and having a structure represented by Formula (2) and/or (3) at at least one end of the main chain, (B) a glycidylamine type epoxy compound represented by Formula (4) or (5) below, (C) a photopolymerizable compound, and (D) a photoinitiator, wherein (A) the alkali-soluble polyimide has a glass transition temperature of 160°C or higher;

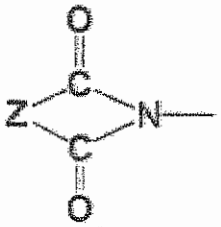
[Chemical Formula 1]



(1)



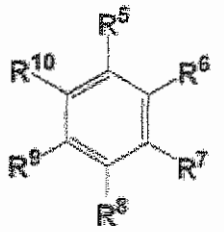
(2)



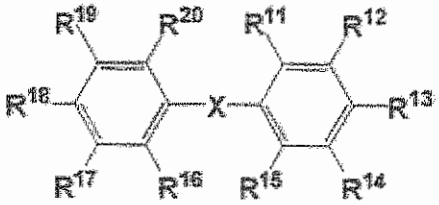
(3)

wherein in Formula (1) to (3) above, Y represents a monovalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group, and Z represents a divalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group; R^1 represents a tetra- to tetradeca-valent organic group; R^2 represents a di- to dodeca-valent organic group; and R^3 and R^4 independently represent at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group; α and β independently represent an integer from 0 to 10;

[Chemical Formula 2]



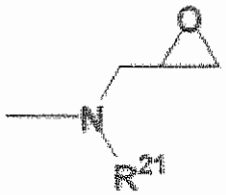
(4)



(5)

wherein in Formula (4) to (5) above, R^5 to R^{20} may be the same or different from each other and are glycidyl ether group, group represented by Formula (6) below, hydrogen atom, or C_1-C_5 alkyl group, provided that, in Formula (4), at least one of R^5 to R^{10} is glycidyl ether group and at least one is group represented by Formula (6) below, or at least two of R^5 to R^{10} are group represented by Formula (6) below; in Formula (5), at least one of R^{11} to R^{15} and at least one of R^{16} to R^{20} are group represented by Formula (6) below; in Formula (5) above, X represents direct linkage, C_1-C_6 alkylene group, ether group, thio ether group, sulfonyl group, or arylene group; the alkylene group may be linear or cyclic;

[Chemical Formula 3]



(6)

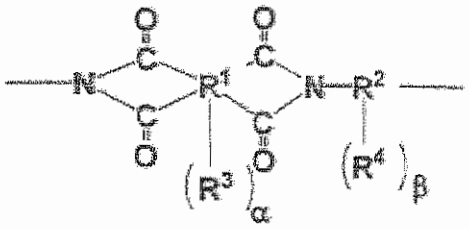
and in Formula (6) above, R^{21} is glycidyl group or C_1-C_5 alkyl group.

[0012b]

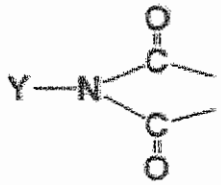
In a second aspect, there is provided a photosensitive adhesive film comprising (A) an alkali-soluble polyimide having structural unit(s) represented by Formula (1) below and having a structure represented by Formula (2) and/or (3) at at least one

end of the main chain, (B) a glycidylamine type epoxy compound represented by Formula (4) or (5) below, (C) a photopolymerizable compound, and (D) a photoinitiator, wherein (A) the alkali-soluble polyimide has a glass transition temperature of 160°C or higher;

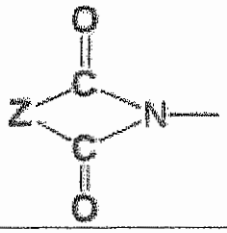
[Chemical Formula 4]



(1)



(2)

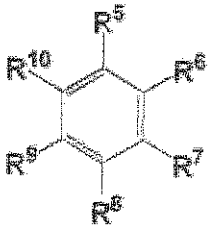


(3)

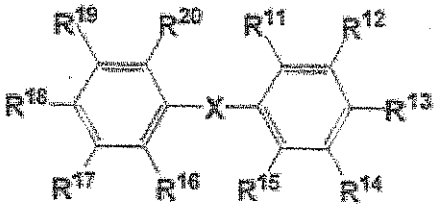
wherein in Formula (1) to (3) above, Y represents a monovalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group, and Z represents a divalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group; R^1 represents a tetra- to tetradeca-valent organic group; R^2 represents a di- to dodeca-valent organic group; and R^3 and R^4 independently represent at least one group

selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group; α and β independently represent an integer from 0 to 10;

[Chemical Formula 5]



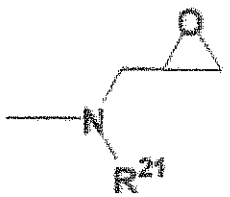
(4)



(5)

wherein in Formula (4) to (5) above, R^5 to R^{20} may be the same or different from each other and are glycidyl ether group, group represented by Formula (6) below, hydrogen atom, or C_1-C_5 alkyl group, provided that, in Formula (4), at least one of R^5 to R^{10} is glycidyl ether group and at least one is group represented by Formula (6) below, or at least two of R^5 to R^{10} are group represented by Formula (6) below; ~~in~~ in Formula (5), at least one of R^{11} to R^{15} and at least one of R^{16} to R^{20} are group represented by Formula (6) below; ~~in~~ in Formula (5) above, X represents direct linkage, C_1-C_6 alkylene group, ether group, thio ether group, sulfonyl group, or arylene group; the alkylene group may be linear or cyclic;

[Chemical Formula 6]



(6)

and in Formula (6) above. R^{21} is glycidyl group or C_1-C_5 alkyl group.

[0012c]

In a third aspect, there is provided a cured product of the photosensitive adhesive composition as defined above or of the photosensitive adhesive film as defined above.

[0012d]

In a fourth aspect, there is provided a semiconductor device having the cured product of the photosensitive adhesive composition as defined above or of the photosensitive adhesive film as defined above.

[0012e]

In a fifth aspect, there is provided a semiconductor device having between circuit components the cured product of the photosensitive adhesive composition as defined above or of the photosensitive adhesive film as defined above, wherein the edges of the cured product are located medially in the edges of the circuit components.

[0012f]

In a sixth aspect, there is provided a semiconductor device obtained by providing at least one of a first jointing terminal surface that a first circuit component has and a second jointing terminal surface that a second circuit component has with a photosensitive adhesive composition coated layer formed from the photosensitive adhesive composition as defined above or from the photosensitive adhesive film as defined above, opening a desired point by patterning, and then electrically connecting said first circuit component and second circuit component by hot-pressing, wherein the edges of the cured product of said photosensitive adhesive composition or photosensitive adhesive film are located medially in the edges of said first circuit component and second circuit component.

[0012g]

In a seventh aspect, there is provided a method of manufacturing a semiconductor device which involves providing at least one of a first jointing terminal surface that a

first circuit component has and a second jointing terminal surface that a second circuit component has with a photosensitive adhesive composition coated layer formed from the photosensitive adhesive composition as defined above or from the photosensitive adhesive film as defineve above, opening a desired point by patterning, and then electrically connecting said first circuit component and said second circuit component by hot-pressing.

EFFECTS ~~OF THE INVENTION~~

[0013]

The present ~~invention~~ disclosure provides a photosensitive adhesive composition having the ability to form patterns with an alkaline developer, excellent thermocompressibility at a low temperature to an irregular substrate after exposure, and a high adhesive strength even at a high temperature.

BRIEF DESCRIPTION OF THE DRAWING

[0014]

Figure 1 illustrates an example of the method of manufacturing a semiconductor device using the photosensitive adhesive composition of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0015]

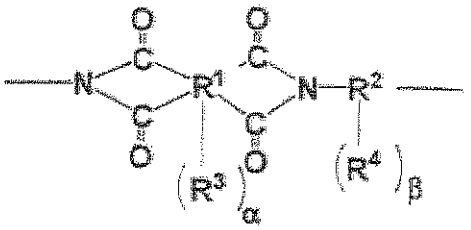
The photosensitive adhesive composition of the present invention comprises (A) an alkali-soluble polyimide having structural unit(s) represented by Formula (1) above and having a structure represented by Formula (2) and/or (3) at at least one end of the main chain, (B) a glycidylamine type epoxy compound represented by Formula (4) or (5) above, (C) a photopolymerizable compound, and (D) a photoinitiator.

[0016]

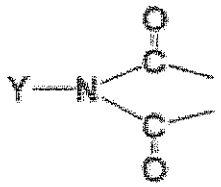
CLAIMS

1. A photosensitive adhesive composition comprising (A) an alkali-soluble polyimide having structural unit(s) represented by Formula (1) below and having a structure represented by Formula (2) and/or (3) at at least one end of the main chain, (B) a glycidylamine type epoxy compound represented by Formula (4) or (5) below, (C) a photopolymerizable compound, and (D) a photoinitiator, wherein (A) the alkali-soluble polyimide has a glass transition temperature of 160°C or higher;

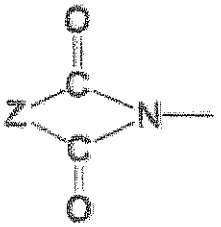
[Chemical Formula 1]



(1)



(2)

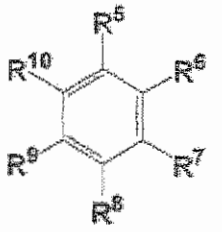


(3)

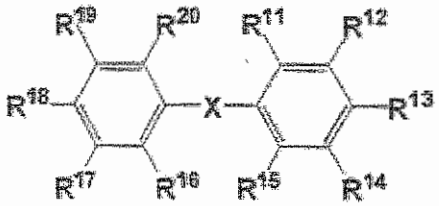
(wherein in Formula (1) to (3) above, Y represents a monovalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group, and Z represents a divalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group; R^1 represents a tetra- to

tetradeca-valent organic group; R^2 represents a di- to dodeca-valent organic group; and R^3 and R^4 independently represent at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group; α and β independently represent an integer from 0 to 10;

[Chemical Formula 2]



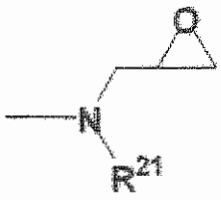
(4)



(5)

wherein in Formula (4) to (5) above, R^5 to R^{20} may be the same or different from each other and are glycidyl ether group, group represented by Formula (6) below, hydrogen atom, or C_1-C_5 alkyl group, provided that, in Formula (4), at least one of R^5 to R^{10} is glycidyl ether group and at least one is group represented by Formula (6) below, or at least two of R^5 to R^{10} are group represented by Formula (6) below; in Formula (5), at least one of R^{11} to R^{15} and at least one of R^{16} to R^{20} are group represented by Formula (6) below; in Formula (5) above, X represents direct linkage, C_1-C_6 alkylene group, ether group, thio ether group, sulfonyl group, or arylene group; the alkylene group may be linear or cyclic;

[Chemical Formula 3]



(6)

and(4 in Formula (6) above, R^{21} is glycidyl group or C_1-C_5 alkyl group.)

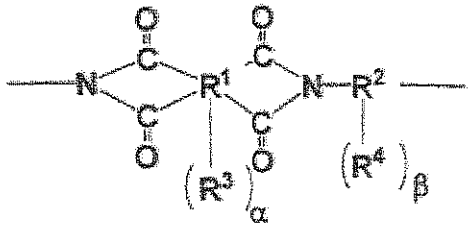
2. The photosensitive adhesive composition according to claim 1, wherein R^{21} in Formula (6) is glycidyl group.

3. The photosensitive adhesive composition according to claim 1 or 2, wherein the alkali-soluble group contained in (A) the alkali-soluble polyimide is phenolic hydroxyl group.

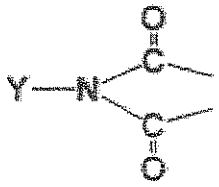
4. The photosensitive adhesive composition according to any one of claims 1 to 3, further comprising (E) a liquid epoxy compound that has aromatic group(s) and does not have any glycidyl amino group.

5. A photosensitive adhesive film comprising (A) an alkali-soluble polyimide having structural unit(s) represented by Formula (1) below and having a structure represented by Formula (2) and/or (3) at at least one end of the main chain, (B) a glycidylamine type epoxy compound represented by Formula (4) or (5) below, (C) a photopolymerizable compound, and (D) a photoinitiator, wherein (A) the alkali-soluble polyimide has a glass transition temperature of 160°C or higher.

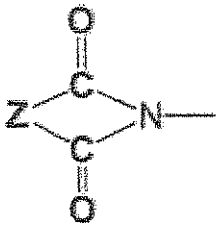
[Chemical Formula 4]



(1)



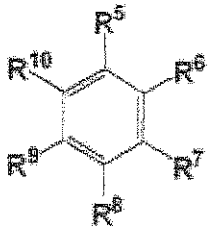
(2)



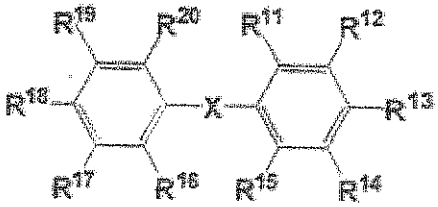
(3)

wherein ~~(~~in Formula (1) to (3) above, Y represents a monovalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group, and Z represents a divalent organic group having at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group;— R^1 represents a tetra- to tetradeca-valent organic group; R^2 represents a di- to dodeca-valent organic group; and R^3 and R^4 independently represent at least one group selected from the group consisting of carboxyl group, phenolic hydroxyl group, sulfonic group, and thiol group;— α and β independently represent an integer from 0 to 10;~~)

[Chemical Formula 5]



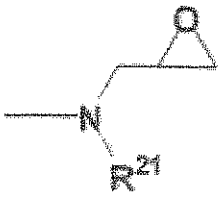
(4)



(5)

wherein (In Formula (4) to (5) above, R^5 to R^{20} may be the same or different from each other and are glycidyl ether group, group represented by Formula (6) below, hydrogen atom, or C_1-C_5 alkyl group, provided that, in Formula (4), at least one of R^5 to R^{10} is glycidyl ether group and at least one is group represented by Formula (6) below, or at least two of R^5 to R^{10} are group represented by Formula (6) below;— In Formula (5), at least one of R^{11} to R^{15} and at least one of R^{16} to R^{20} are group represented by Formula (6) below;— In Formula (5) above, X represents direct linkage, C_1-C_6 alkylene group, ether group, thio ether group, sulfonyl group, or arylene group;— The alkylene group may be linear or cyclic.)

[Chemical Formula 6]



(6)

(and In Formula (6) above, R^{21} is glycidyl group or C_1-C_5 alkyl group.)

6. The photosensitive adhesive film according to claim 5, wherein R^{21} in Formula (6) is glycidyl group.

7. The photosensitive adhesive film according to claim 5 or 6, wherein the alkali-soluble group contained in (A) the alkali-soluble polyimide is phenolic hydroxyl group.